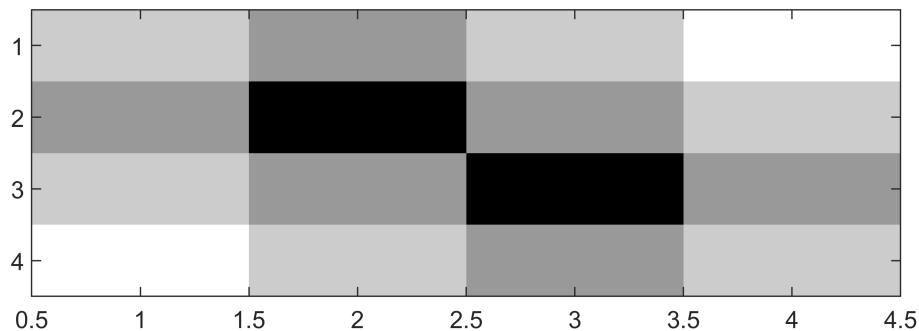
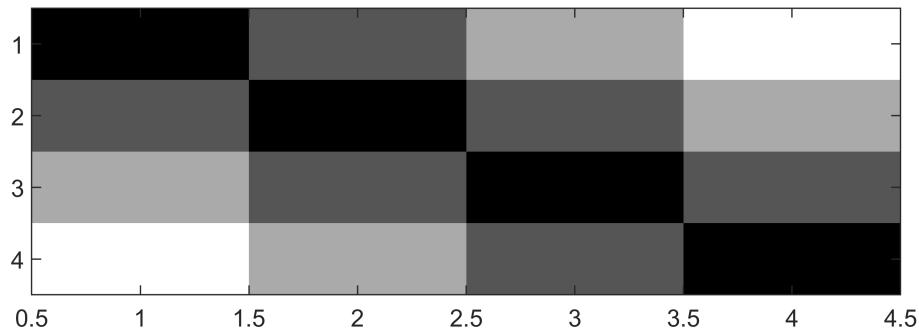


```
% Exercise 1a
figure
I = imread('peppers.png');
subplot(321);
imshow(I);
Is = rgb2gray(I);
subplot(322); imshow(Is);
h = fspecial('sobel');
If = imfilter(I, h, 'conv', 'circular');
subplot(323)
imshow(If);
h1=ones(15,15);
h = h1/sum(sum(h1));
If = imfilter(I, h, 'conv', 'circular');
subplot(324);
imshow(If);
```



1b

```
figure
A=[0 16 32 48;16 0 16 32;32 16 0 16;48 32 16 0];
h=1/9.*ones(3,3);
lf=imfilter(A,h, 'conv', 'circular');
ax1=subplot(211);imagesc(A);colormap(ax1, 'gray');
ax2=subplot(212);imagesc(lf);colormap(ax2, 'gray');
```



```

function Af = customimfilter(A, h)
[N, M] = size(A);
n = floor(size(h, 1)/2);
Af = zeros(size(A));

for x = 1:N %for each line
    for y = 1:M %for each column
        for i = -n:n
            for j = -n:n
                i2 = i+n+1;
                j2 = j+n+1;

                x2 = x - i;
                if (x2 <= 0)
                    x2 = x2 + N;
                elseif (x2 > N)
                    x2 = x2 - N;
                end

                y2 = y - j;
                if (y2 <= 0)
                    y2 = y2 + M;
                elseif (y2 > M)
                    y2 = y2 - M;
                end

                Af(x,y) = Af(x,y) + h(i2,j2)*A(x2,y2);
            end
        end
    end
end

```

Exercise 2

2a

```
figure  
I = imread('peppers.png');  
imshow(I)
```



2b

Blur Gaussian filter

```
h = 1/256*[1 4 6 4 1; 4 16 24 16 4; 6 24 36 24 6; 4 16 24 16 4; 1 4 6 4 1];  
If = imfilter(I, h, 'conv', 'circular');  
imshow(If);
```



Motion filter

```
h = zeros(9, 9);
for i = 1:length(h)
    h(i, i) = 1;
end
h = h/sum(sum(h));
If = imfilter(I, h, 'conv', 'circular');
imshow(If);
```



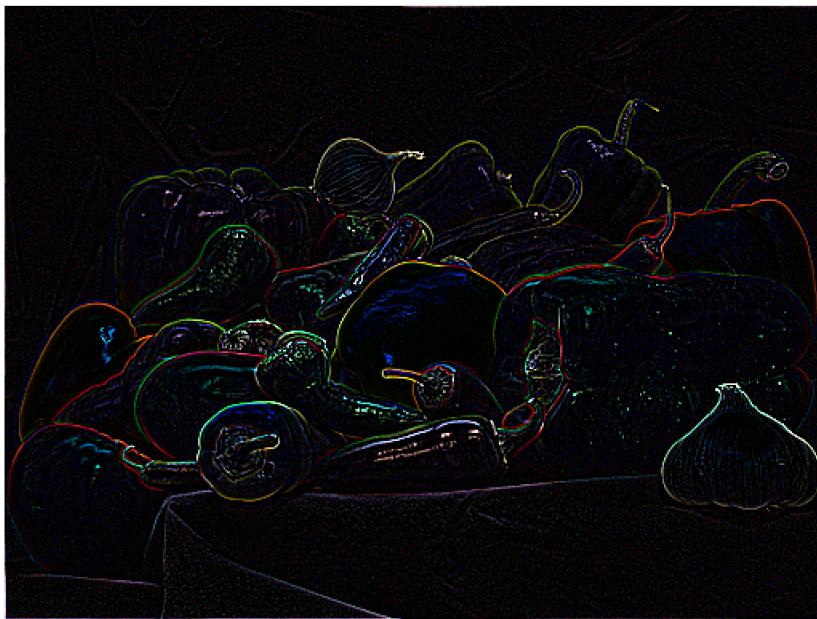
Sharpening

```
h = [-1 -1 -1; -1 9 -1; -1 -1 -1];
If = imfilter(I, h, 'conv', 'circular');
imshow(If);
```



Edge detection

```
h = [-1 -1 -1; -1 8 -1; -1 -1 -1];
If = imfilter(I, h, 'conv', 'circular');
imshow(If);
```



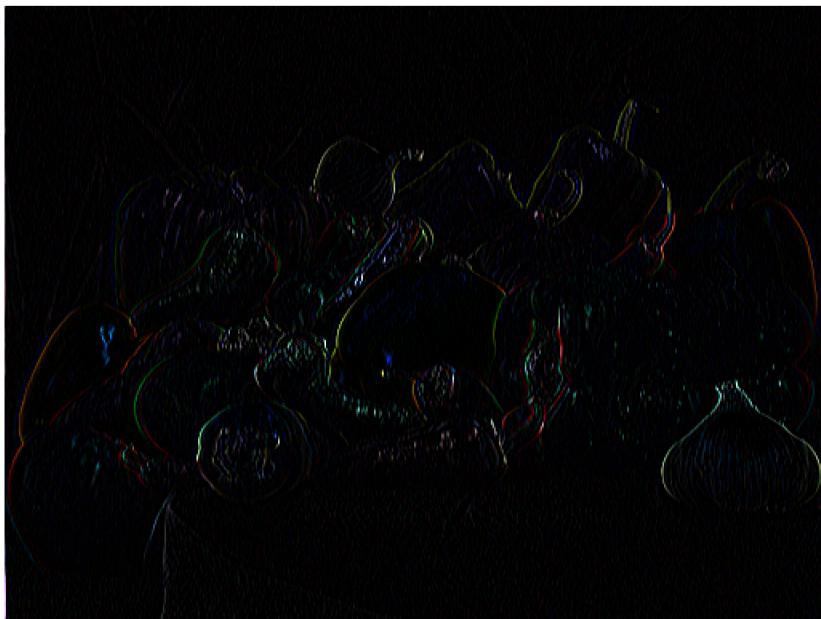
Horizontal line detection

```
h = [-1 -1 -1; 2 2 2; -1 -1 -1];
If = imfilter(I, h, 'conv', 'circular');
imshow(If);
```



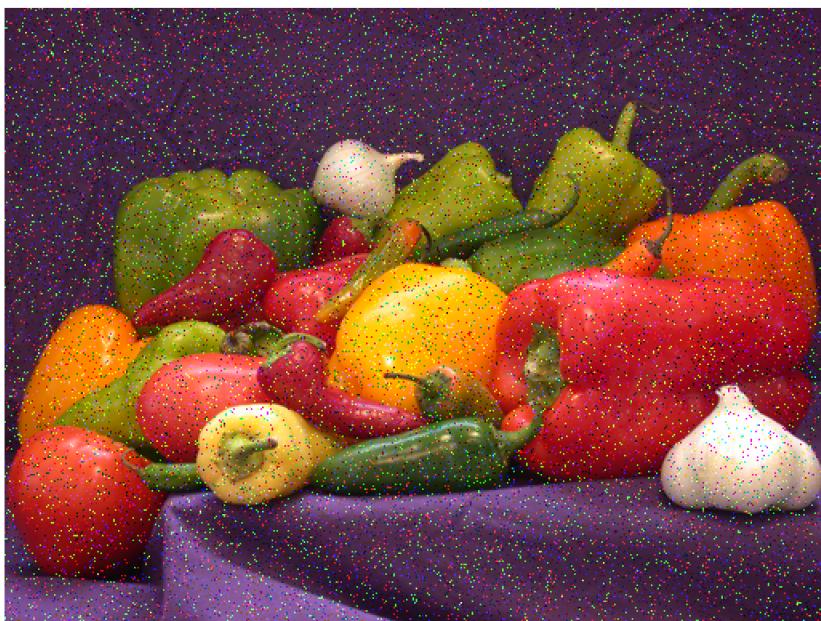
Vertical line detection

```
h = [-1 2 -1; -1 2 -1; -1 2 -1];
If = imfilter(I, h, 'conv', 'circular');
imshow(If);
```



2c

```
If2 = imnoise(I, 'salt & pepper');
imshow(If2);
```



2d

```
imwrite(If, 'photo1_noise', 'jpg')
```

2e

```
h = 1/9*[1 1 1; 1 1 1; 1 1 1];
If = imfilter(I, h, 'conv', 'circular');
imshow(If);
```



% The image becomes brighter if we increase the filter size

```
h = 1/9*[1 1 1; 1 1 1; 1 1 1];
If = imfilter(I, h, 'conv', 'circular');
imshow(If);
```

